the United States does and fish exports from Europe to the United States may be seriously reduced. The fishery resources of the United States may not be rich enough to replace diminishing imports from Europe. Our studies must extend to research on resource development and its economic basis.

It may be that fresh water pond fish production can supplement fish production from the sea. There are already more than a million fish ponds in the United States and pond fish production has made good progress in some Caribbean countries, for example, Haiti. While the production from these ponds is not great at present, it may increase and eventually become a great source of food. Studies should, then, consider the economic importance of pond fish production.

Forecasts for the United States indicate that there will be a reduction of the working hours per week to about 38 by 1967, which leaves more time for leisure. There may, as a consequence, be more fish caught by sport fishermen with a resulting decrease in demand for commercially produced fish. We should keep a watchful eye on the fish production by anglers and sportsmen, and evaluate its economic importance.

I do not share the view of some economists that this country will continue to increase its production level at a high rate. Some economists believe that each individual in the United States will spend $1,970 on consumer expenditures in 1965 as compared with $1,530 in 1955. I consider this possible only under conditions of a continued inflation of about three per cent per year. If the Federal Reserve Board continues its present policy of stemming inflation, neither a 30 per cent inflation nor a 28 per cent increase in consumer expenditures will occur during the next ten years. Inflation increases the prices fishermen have to pay for their goods more than it does the price of fish landed. The value of food fishes increased only 6.9 per cent in the last ten years on a volume basis. With continued inflation the commercial fisherman will be the loser. Our Institute must continuously study the monetary values, consumer spending, fish prices and their interrelations.

Assuming a stable economy all over the world for the next ten years, population increases and the changing demand will be of a great challenge to fish producers, processors and dealers in the Gulf and Caribbean area. The greatest challenges will be in how to produce more fish and how to provide diversification of fishery products as required by the changing composition of the population. It is to be hoped that the tremendous development in the shrimp industry in the Gulf and Caribbean area will continue and that other fish industries, for example, the tuna industry in the Gulf, will experience similar growth. The Gulf and Caribbean Fisheries Institute, by its discussions of the economic problems, will hope to contribute even further to the improvement of the fishery industry in the future than it has in the past.

Progress in Fisheries Education in the Gulf and Caribbean Area, 1948 - 1957

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EVERYONE having any connection with fisheries, whether from the industrial or professional point of view, has been made repeatedly conscious of the severe

shortage of technically trained fishery scientists. Directors of fishery research programs spend a considerable part of their time searching for men to carry out the increasingly complex tasks that are posed to the science of fisheries. Despite this energy, which should be available for more productive activities, many fishery staffs are forced to include people only partly trained or actually untrained in fisheries or its related disciplines. The new information, which has been accumulating at accelerating rate in recent years, makes it the more necessary for the universities to turn out trained technical scientists.

In addition, the fisheries of the Gulf and Caribbean area have had a considerable growth in recent years. This adds local urgency to the country-wide problem and makes it especially worthwhile to examine, on the occasion of our tenth meeting, the progress made in fishery education in this area and in the period of the existence of the Gulf and Caribbean Fisheries Institute.

This progress has been good. Before we can defend this statement properly, however, we will have to decide what to include when we speak of "fisheries education." Perhaps the simplest and most useful definition is that fishery education is training that prepares a man with the knowledge and skills necessary to solve fishery problems. This means that a good training in zoology (or sometimes chemistry or one of the other sciences) can lead a man to a useful career in fisheries science. However, as fisheries develops its own techniques, there is an increasing need for training in these special procedures. Certainly some of the most useful work in this field will continue to be done by men who have never taken a "fisheries" course, but it seems certain that the great advances in the science—the "break-through" progress which will lead to new plateaus of understanding—will be achieved to an increasing degree by men who have studied the specialized aspects of fish population work and the newer techniques which are beyond the purview of classical zoology.

Thus, in considering fishery education programs in the Gulf and Caribbean area, we will limit it to courses of training in marine biology, oceanography and fisheries, which can lead to a solution of marine fisheries problems. (We omit, for our present purpose, freshwater fishery training.)

Fishery education can be divided into a number of categories: (1) the training of fishermen in new techniques and procedures, (2) fishery education in the secondary schools, (3) professional education at the university level in fisheries and other marine sciences.

Vocational education for fishermen and secondary school education have only begun to be started on a small scale in the last two years in our region. We are on the verge of considerable activity in this type of work, if present indications are reliable. A bill, sponsored by Senator Frederick Payne of Maine, and put into effect by the last Congress, is largely responsible for this, and several states, notably Louisiana and Texas, have already begun to organize training to improve the efficiency of fishing operations and to attract new recruits to the trade.

In Florida our own University, with the help of the Florida State Board of Conservation, organized and assisted in the conduct of a fisheries club among high school students in Ft. Myers. We had hoped that this would be the prototype of a number of similar clubs, which would encourage boys to enter either the trade of fishing or the field of professional marine science. Whether this hope will be realized remains to be seen.

Fishery education in the Caribbean area has been supported by the Food and Agriculture Organization, which sponsored two short schools in fishery

biology (Valparaiso, Chile in 1952, and Mexico City, 1954), and in 1957 conducted a course in fishery technology in Lima, Peru. These courses, of about two months duration, draw men from many Latin American countries and present to them the elements of fishery science. This activity should have good results, and may be the spark to alight productive interest in professional fishery activities in this area where little such research has been conducted.

Professional training in fisheries and other marine sciences in the universities is at two levels in our area. First, there are universities and especially marine stations, which offer summer courses in these subjects, or which offer some specialized courses in the marine sciences during their regular session, but which do not grant degrees in this specialty. This group includes such institutions as the College of William and Mary, the University of Georgia, Louisiana State University, the University of Texas, University of Florida, Duke University and Florida State University.

The Virginia Fisheries Laboratory is affiliated with the College of William and Mary, and offers some academic training in fisheries. Dr. J. L. McHugh, Director of the Laboratory, state ". . . our graduate program . . . is much less formal than the usual program on a college campus. . . . we do not offer any formal courses, but try to broaden the students' training by offering courses under the category 'Problems in Biology' in as wide a variety of subjects as our staff members are qualified to teach . . ."

Tulane gives graduate courses in ichthyology and fishery biology, in alternate years. The University of Georgia offers a two-quarter course entitled Marine Biology, which embraces principles of oceanography with emphasis on biology, and a course in ichthyology. Louisiana State University supports a faculty member at the Gulf State Research Laboratory at Ocean Springs, Mississippi, during the summer, and sponsors summer courses there in Marine Zoology, Marine Biology for Teachers and Problems in Marine Biology.

The University of Texas has offered summer courses in Marine Fisheries Biology, Marine Vertebrate Zoology, Marine Invertebrate Zoology and Biological Oceanography when demands justify it. This program is being broadened to include geology, botany and bacteriology. Florida lists one marine course (Marine Ecology). At the University of North Carolina zoology students may take several courses in marine subjects and pursue research at the affiliated Institute of Fisheries Research at Morehead City, North Carolina.

At Duke University courses such as Marine Ecology, Marine Invertebrate Zoology and Marine Algae are offered, among others. Duke also gives summer courses at its Marine Laboratory at Beaufort, N. C. Support is given to these by the nearby Fisheries Laboratory of the Fish and Wildlife Service, whose staff also attends courses in such topics as fish population dynamics and biometrics.

Among the institutions in this first group, Florida State University offers the largest number of courses in fisheries and cognate subjects. These courses, which include such specialized subjects as Marine Bacteriology, Gulf Coast Ecology, Elementary Physical Oceanography, Plankton and Biology of Fishes, are offered by the various science departments. Many of the courses helpful in training a marine fishery scientist are at the graduate level, and a student can get an advanced degree in Bacteriology, Botany, Geology, Meteorology or Zoology with at least some marine courses if not a strong specialization in problems of the sea.

The second group institutions in the area are those which offer a specially

designed marine science curriculum and grant degrees in Oceanography, Fisheries or Marine Biology. These include Texas A & M College and the University of Miami.

Texas A & M established a Department of Oceanography in 1950. Students are offered the choice of five areas of specialization at the graduate level and may also take an undergraduate curriculum in meteorology. The graduate options are Physical Oceanography, Biological Oceanography, Meteorological Oceanography, Chemical Oceanography and Geological Oceanography. More emphasis is placed at this school on the physical science aspects of ocean study than on the biological, as evidenced by the fact that six out of the seven Ph.D. degrees granted up to January, 1957, were in geological, physical, chemical or meteorological oceanography, and 26 of the 28 masters degrees were in these categories.

At the University of Miami fisheries and allied courses are taught in the Department of Marine Sciences. This department was established as a separate academic unit in 1949, with the realization that the study of the sea encompassed all the sciences, and that specialized consideration of marine problems required a special approach. No undergraduate degree is offered in Marine Sciences, students being accepted to a graduate program after having obtained a sound training in one or more of the sciences. Three options are available for students seeking the M.S. degree, these being Marine Biology, Oceanography and Fisheries.

Marine Science courses are taught by senior staff members doing research in The Marine Laboratory and an important part of the student's training is his internship as an assistant on research projects. Marine courses include Marine Biology, Marine and Freshwater Plankton, Physiology of Marine Organisms, Chemical Oceanography, Marine Geology, Fishery Biology and Management and a considerable number of other specialized courses.

A few of the courses in some of the universities mentioned above were in existence in 1948, when the Gulf and Caribbean Fisheries Institute was founded, but the number was small and most of them were of the classical zoology type. In a paper entitled, "Education and Training for Oceanographers," published in 1950 (Knudsen et al., 1950), no institutions in the Southeast or Gulf and Caribbean areas were listed among the "well established oceanographic laboratories." Among schools in this area only Texas A & M and the University of Miami are listed as offering "courses in oceanography" or "conducting research involving oceanography," and these were mentioned almost in passing. Thus, virtually all the specialized training in marine work which could be called "fisheries education" has been started since the Institute began in 1948. It may therefore be said with confidence that very considerable progress has been made in this field in the years under consideration.

What can we expect in the next ten years? I have no doubt at all that the present strong demand for trained fishery scientists will increase steadily in the next decade. Demand stimulates supply and more opportunities for training in this field are certain to be offered. Dr. Dale Leipper, Head of the Department of Oceanography at Texas A & M, writes, "We are beginning a new period of emphasis on the applications of oceanography to fishery problems. . . . our emphasis will continue to be upon the environment as it affects the fisheries." At our own institution we feel that we are also on the verge of a period of fruitful expansion. Beginning in September, 1958, we will accept applications for ad-

mission to a Ph.D. program in Fisheries, Marine Biology and Oceanography. This program will start in 1959.

An educational program has one basic and necessary ingredient—students. A good faculty and well equipped library and laboratory facilities are of little use if students cannot be induced to use them. The shortage of scientists of all kinds is too familiar a complaint to dwell long upon here, but it can be said with much truth that the shortage is more severe in fisheries and other marine sciences than in most other areas. The reason for this is a compound of salaries, which are lower than those for men of comparable training, and a general unfamiliarity on the part of students with the very existence, let alone the satisfactions, of fisheries science as a career. The situation is being improved by an increasing salary scale, wider information about the profession and increasing financial aid for fisheries students. It is significant that industry recognizes the problem of attracting able men to the marine science profession, and Texas A & M lists three industrial fellowships. Of particular interest to the fishing industry of this area are the Shrimp Association of the Americas Graduate Fellowships, which were set up at the University of Miami this year by the joint shrimp industries of Mexico, Florida and Texas. This type of foresightedness on the part of industry is bound to have far reaching good effects.

The past decade has shown a substantial increase in the awareness of need for fisheries education in this area, with marine courses being added in many Universities and teaching and research facilities being greatly increased. There is every reason to believe that this trend is gathering strength and we can hope for much greater progress in the decade ahead.

A Decade of Progress in Fishery Biology of the Gulf and Caribbean Area

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THE OFFICERS of your organization asked me to discuss at your opening session the progress made during the past decade in the studies of biological problems pertaining to the fisheries of the Gulf and Caribbean area. I am very happy to address this meeting today because the Gulf and Caribbean Fisheries Institute, inaugurated in 1948, was a major factor in this progress. In his welcoming speech, Dr. F. G. Walton Smith, the chairman of the inaugural session said: ". . . The Institute . . . seeks to bring together first of all fishermen, the fish dealers, the fish processors; secondly, the fishery biologists, technologists and economists; and thirdly, the conservation administrators of the fisheries. In this manner it is believed that the several groups of persons . . . may have an opportunity of broadening their horizons and of seeing their problems in a truer perspective against the background of fisheries as a whole." Those of us who have followed the growth and activities of the Institute have no doubt that this particular aim, outlined by its originator, has been fulfilled. The Institute has provided the means of understanding and communication between